

Superior Speech Acquisition and Robust Automatic Speech Recognition for Integrated Spacesuit Audio Systems, Phase I

Completed Technology Project (2009 - 2009)



Project Introduction

Astronauts suffer from poor dexterity of their hands due to the clumsy spacesuit gloves during Extravehicular Activity (EVA) operations and NASA has had a widely recognized but unmet need for novel human machine interface technologies to facilitate data entry, communications, and robots or intelligent systems control. In this proposed Phase I research, WeVoice, Inc., plans to design, to begin the implementation of, and to evaluate a speech human interface system. Loud noise and strong reverberation inside spacesuits make automatic speech recognition (ASR) for such an interface a very challenging problem. WeVoice proprietary microphone array signal processing algorithms for speech acquisition will be taken advantage of. Pros and cons of beamforming vs. multichannel noise reduction for ASR will be assessed and recommendations for the best front-end technique will be established. Using two ASR programs (one based on HTK and the other in C/C++) that were previously developed at WeVoice, Inc., a number of robust methods (ranging from feature transformation and normalization to environmental adaptation) will be validated. In addition, the feasibility of using throat vibration microphones will be explored. The Phase I research is also concerned with the compromise of ASR accuracy and system complexity. A comparative study will be undertaken between two system implementation structures, namely wearable and distributed systems. This effort will form a foundation for prototype design to be conducted in Phase II.

Anticipated Benefits

Potential NASA Commercial Applications: 1. Speech-driven intelligent systems used in military and other noisy environments. 2. Information and computer systems used by disabled persons or people with poor manual dexterity.



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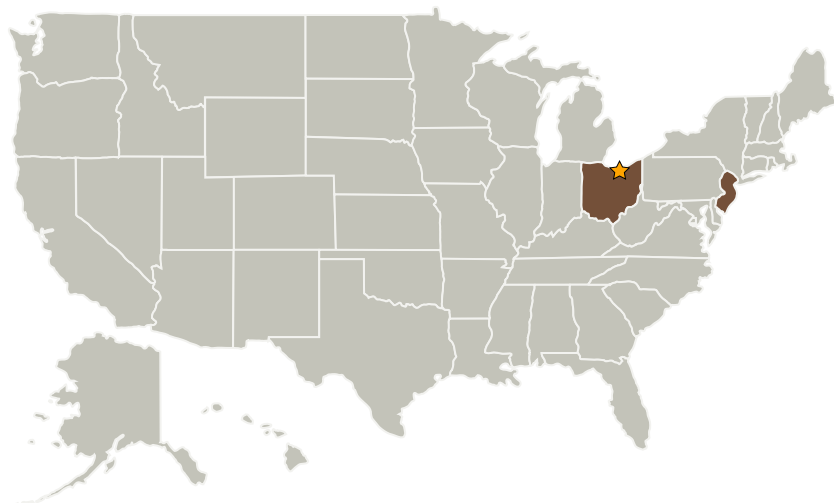
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
WEVOICE, Inc.	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Bridgewater, New Jersey

Primary U.S. Work Locations	
New Jersey	Ohio

Project Transitions

January 2009: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

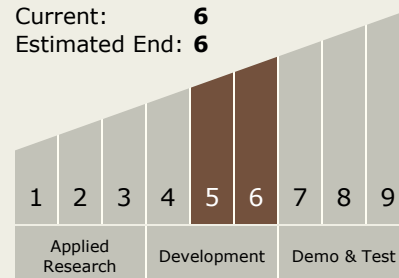
Carlos Torrez

Principal Investigator:

Yiteng Huang

Technology Maturity (TRL)

Start: 5
Current: 6
Estimated End: 6



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July 2009: Closed out

Closeout Summary: Superior Speech Acquisition and Robust Automatic Speech Recognition for Integrated Spacesuit Audio Systems, Phase I Project Image

Technology Areas

Primary:

- TX16 Air Traffic Management and Range Tracking Systems
 - └ TX16.3 Traffic Management Concepts